The coupling between the AMOC and the atmosphere in CCSM3.

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The AMOC influence on the atmospheric circulation is investigated in a control simulation of CCSM3, using maximum covariance analysis. It is shown that the AMOC influence varies with the AMOC regime. In the second part of the simulation when the AMOC has a red-noise behavior, an intensification of the AMOC is followed after a few years by a positive NAO phase. The atmospheric response seems controlled by the AMOC-driven sea surface temperature (SST) anomalies, which affect the surface heat exchanges and shift the maximum heat release to the atmosphere northward. This shifts the maximum near-surface baroclinicity of the atmosphere northward in the storm track region, thus favoring a positive NAO. As the AMOC is largely driven by the NAO, the atmospheric response acts as a weak positive feedback. The SST influence on the NAO is also detected at the seasonal scale. However, there is no resemblance with the influence of the North Atlantic horseshoe SST anomaly pattern on the NAO, which was detected in the observations, or between the observed and the model Atlantic multidecadal oscillation. These discrepancies appear to result from the strong link in CCSM3 between the AMOC variability and the Gulf Stream-North Atlantic current.